Remarks

Claims 1 to 7, 11 to 16 and 21 are currently pending in the application.

In the instant Amendment, claim 1 has been amended to replace the transitional phase "containing" with "consisting essentially of" and to replace the term "high strength electrical steel sheet" with "high strength non-oriented electrical steel sheet" to more clearly recite the invention. Support for the amendment is found, for example, at page 1, lines 8-12 of the specification. Claim 1 has also been amended to recite that the high strength non-oriented electrical steel sheet contains, by mass %, 0.0031 to 0.0301% of N. Support for the amendment is found, for example, at page 11, lines 18-19 of the specification.

Claims 2 and 3 have been amended to be independent, incorporating the limitations of claim 1.

Claims 4-7, 11-16 and 21 have been amended to have the proper antecedent basis and to correct grammatical or editorial errors.

No new matter has been introduced by the present amendments.

Entry of the foregoing amendment and consideration of the following remarks are respectfully requested.

Claim rejections under 35 U.S.C. §103

Claims 1-7, 11-16 and 21 are rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese patent publication JP 09-241793 ("JP '793") for the reasons set forth on pages 2-4 of the Office Action.

Claim 1 has been amended to recite a high strength non-oriented electrical steel sheet consisting essentially of, by mass %, C: 0.06% or less, Si: 2.0 to 6.5%, Mn: 0.05 to 3.0%, P: 0.30% or less, S or Se: 0.040% or less, Al: 2.50% or less, Cu: 0.6 to 8.0%, Cr: 4.5% or less, N: 0.0031 to 0.0301%, and a balance of Fe and unavoidable impurities and containing a metal phase comprised of Cu having a diameter of 0.1 μm or less in the steel sheet by means of holding the steel sheet in a heat treatment at a temperature range of 300°C to 650°C for 5 seconds or more.

The present invention provides a high strength non-oriented electrical steel sheet which is high in strength and wear resistance and is superior in magnetic properties such as magnetic flux density and core loss. The electrical steel sheet of present invention can be produced without greatly changing the productivity such as cold rollability from that of

conventional electrical steel sheet production process. The electrical steel sheet of the present invention is especially suited for use in, e.g., high speed rotary machines requiring strength, electromagnetic switches requiring wear resistance, etc.

JP '793 discloses an Fe-Cu alloy steel superior in a balance between strength and ductility and a balance between strength and toughness by controlling the crystal structure of Cu precipitates in the steel. JP '793, however, does not teach or suggest a non-oriented electrical steel sheet having high strength and wear resistance as well as a high Si content of 2.0-6.5% for superior magnetic properties, such as magnetic flux density and low core loss.

Moreover, the non-oriented electrical steel sheet of the present invention contains 0.0031-0.0301% of N for improving the texture in addition to increasing yield stress, high temperature strength, creep strength and fatigue properties (*see* page 11, lines 12-24 of the specification). On the contrary, JP '793 does not disclose a Fe-Cu alloy containing N, let alone the recited amount of N according to the present invention. It is clearly seen that the Fe-Cu alloy of JP '793 does not teach that its steel contains any N or nitrides (*see* JP '793, paragraphs [0010]-[0012] and [0016]; and Table 1). Thus, the effect of improving the texture in addition to increasing yield stress, high temperature strength, creep strength and fatigue properties by adding 0.0031-0.0301% of N is not taught by JP '793. One of ordinary skill in the art following the disclosure of JP '793 would not have obtained the high strength non-oriented electrical steel sheet of the present invention.

Accordingly, the rejection of claims 1-7, 11-16 and 21 under 35 U.S.C. §103(a) as obvious over JP '793 cannot stand, and should be withdrawn.

Claims 1-7 and 11-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese patent publication JP 09-209039 ("JP '039") for the reasons set forth on pages 2-4 of the Office Action.

JP '039 relates a cold-rolled steel sheet having high strength, excellent in press-forming nature and deep drawability, which can be used as inner plate for cars. JP '039, however, does not teach or suggest a non-oriented electrical steel sheet having high strength and wear resistance as well as a high Si content of 2.0-6.5% for superior magnetic properties, such as magnetic flux density and low core loss.

In contrast to the presently claimed invention, JP '039 teaches adding 2.0% or less of Si in their steel composition. JP '039 clearly describes that Si content exceeding 2.0% is not

desirable because when the Si content exceeds 2.0% of the weight, it causes the tendency for ductility and a Lankford value to fall (*see* JP '039, paragraph [0007]).

In addition, JP '039 targets to develop {554} texture parallel to the plane of the steel sheet (*see* JP '039, paragraphs [0005] and [0006]). This {554} texture is very close to {111} texture. As is understood by a person skilled in the art in the technical field of electrical steel sheet, {111} texture includes {110} texture which is difficult to magnetize, but does not include {100} texture which is easily to magnetize. Therefore, it is not preferable to develop {111} texture parallel to the plane of the steel sheet. The present invention seeks to suppress the development of {111} orientation not desirable for magnetic properties and enhance the development of the preferable {110}, {100}, {114}, etc., orientation. *See* page 8, lines 6-10 of the specification.

Furthermore, the process according JP '039 rapidly cools a hot-rolled steel sheet with a cooling rate of more than 20°C/sec and coiling the steel sheet in a temperature range of 450-650°C so as to develop {554} texture at the surface of the annealed steel sheet (*see* JP '039, paragraphs [0004]-[0005]). As a result, coarse Cu precipitates are formed during the coiling of the hot-rolled steel sheet. On the other hand, according to the present invention, a hot-rolled steel sheet is slowly cooled for less than 300 seconds in a temperature range of 700°C to 400°C (Table 7 of the specification shows the cooling time of 20-120 seconds, which corresponds to 2.1-12.5°C/sec) to provide a non-oriented electrical steel sheet containing Cu appropriately treated to form a fine Cu metal phase so as to maintain good magnetic properties. For instance, in the present invention, the metal phase mainly comprised of Cu having a diameter of 0.1 μm or less, more preferably 0.01 μm or less. If the diameter is more than 0.1 μm, the efficiency of increasing the strength falls. In this condition, not only a large amount of metal phase becomes necessary, but also the detrimental effect on the magnetic properties becomes greater. From the viewpoint of increasing the strength and the magnetic properties, the diameter is preferably 0.008 μm or less, further 0.005 μm or less, and more preferably 0.002 μm or less (*see* page 18, line 36 to page 19, line 26 of the specification).

For at least the reasons presented above, one of ordinary skill in the art following the disclosure of JP '039 would not have obtained the claimed high strength non-oriented electrical steel sheet of the present invention. Accordingly, the rejection of claims 1-7 and

11-16 under 35 U.S.C. §103(a) as obvious over JP '039 cannot stand, and should be withdrawn.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the present application is in condition for allowance. Early and favorable action by the Examiner is earnestly solicited. If the Examiner believes that issues may be resolved by a telephone interview, the Examiner is invited to telephone the undersigned at the number below.

Respectfully Submitted,

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